CASE OF A MAN BLIND FROM CONGENITAL CATARACT WHO ACQUIRED SIGHT AFTER AN OPERATION WHEN HE WAS 30 YEARS OF AGE.

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cleanly through soft tissues will produce damage over and above the direct destruction incident to its passage we have seen many proofs in the intractable neuralgia in wounds of limbs, in cases where the nerves affected could not by any means have been directly involved. In some such cases the absence of any traceable morbid condition has been demonstrated by operative examination.[3] The production of this disability in structures distant from the actual lesion has been ascribed to the shock produced by the "expanding force" of the missile. If such effects are marked in the case of passage through the soft parts of a limb, composed of comparatively coarsely organised tissues, how much greater the effect of such a force acting upon the brain—first from the blow to the skull and, secondly, from the passage of the missile through a highly organised nerve mass inclosed within an unyielding envelope.

CONCLUSIONS.

Whilst it would be unwise to base any elaborate deductions upon one set of observations there are certain points of interest which arise out of this case and the experimental demonstration thereof.

The transient motor paresis.—According to the localisation of the motor areas by Ferrier, Horsley, and Beevor the destruction of the ascending parietal convolution at the wound of entrance should have produced a serious and probably permanent paralysis. The man has early and almost completely recovered from the motor disability. This fits in with the more recent localisation of the motor areas in the anthropoid apes by Sherrington and Grünbaum[4] in which the area was bounded posteriorly by the Rolandic fissure and did not extend to the ascending parietal fissure or that part of it dipping into the fissure. The shock of the injury in the region of the ascending frontal convolution one would judge to be quite enough to account for the symptoms described. It is also noteworthy that the entrance wound is nearest the site of the arm area, in which limb there remains some slight weakness.

The hemianopsia.—The penetration of the occipito-thalamic radiation and the undermining of the angular gyrus and occipital lobes are so thorough that at first sight it would appear that no evidence could be gleaned from this case in the vexed question of the relation of psychic and perceptive visual centres to those cortical areas; also the general features of the fields of vision in the preservation of the central areas (complete within the 5° circle) and the retention of the portions supplied by the right side of the cortex are so well known as to call for no special comment. There is, however, one point of importance—the rim of blindness found along the left side of the left field, indicating the existence of a defect in the area held to be supplied by nerve fibres connected with the right cortex. How may this rim of blindness be accounted for? There is, of course, no evidence that the man's field was full in this direction prior to the injury, but an explanation obtained by a negation of this sort is hardly tenable. The matter is complicated by the fact that the blind rim corresponds to that portion of the right field normally absent—it is amblyopic on account of disuse caused by the obstructing nose; as has been stated no further diminution of this region could be discovered. The blind rim might be held to be a defect due to intraocular conditions following the injury, but there were neither ophthalmoscopic changes nor defective pupillary reaction to lend support to such a view. There remain two possible explanations. One is the hypothesis of Charcot[5] that there is a double decussation of the optic nerve and its connexions, one at the chiasma and another in the hemisphere; this scheme would supply the suggestion that the fibres derived from this blind rim were really connected with the left cortex and were destroyed within the left hemisphere after they had made their secondary crossing from the right. In the absence of any more direct and more feasible explanation the occurrence of this blind rim might perhaps be held to support Charcot's hypothesis. The second and more likely solution of the difficulty, and one which leads to a rather interesting deduction, is that the rim is the result of an injury to the right cortex. It has been noted how close to the middle line was the presumptive wound of exit, only half an inch to the left of that line. The right occipital cortex may well be held to be within the danger zone of this wound. In what way an injury occurred it is impossible to determine. Shock alone may have been of sufficient intensity permanently to incapacitate its cellular structure, mayhap the damage arose in some small hæmorrhage or in a disturbance of its venous circulation by a clot in one or other of the sinuses immediately contiguous to the wound. With an acceptance of this solution—damage to the immediately contiguous right occipital cortex—there follows the interesting deduction that the periphery of the visual field is connected with that part of the cortex situated in the posterior inferior margin of the middle occipital convolution as it blends with the mesial area known as the cuneus.

Whilst it would be presumption to base any elaborate conclusions on such evidence as this—that of a single case, and one in which an injury to the right cortex cannot be proved to exist, or existing its nature and cause cannot be determined—yet it may be noted that this deduction will very well harmonise with the generally accepted view that the central area of the visual field has its cortical connexion towards the apex of the cuneus, and support the view that the perceptive centre for vision is situated in the occipital and cuneate regions rather than in the more anterior angular gyrus. Of the psychic visual centre this case gives no information.

Index to the figures.—The scale is marked on each figure except 7 and 8 which are the same as 9. A., nasion; B., bregma; C., lambda; D., inion (external occipital protuberance); E., external auditory meatus; A.W., anterior wound; P.W., posterior wound; e.a.p., external angular process; S.p., Sylvian point; I.R., island of Reil; v., posterior horn of the lateral ventricle; c.c., corpus callosum; c.nu., tail of the caudate nucleus; co.f., collateral fissure; c.f., calcarine fissure; f.R., Rolandic fissure; f.S., Sylvian fissure; f.p.o., parieto-occipital fissure; f.c.m., calloso-marginal fissure; ip.f., interparietal fissure; p.f., parellel fissure; s.s.f., superior frontal sulcus; s.i.f., inferior frontal sulcus; m.o.c., middle occipital convolution; a.g., angular gyrus; g.f., gyrus fornicatus; sm.c., supra-marginal convolution; cn., cuneus; q.d., quadrate lobe; and m.c., marginal convolution.

[3] Clinton J. Dent: Brit. Med. Jour., February, 1900, p. 406.
[4] Sherrington and Grünbaum: Transactions of the Pathological Society of London, 1902, p. 130.
[5] McKendrick's Text-book of Physiology, 1889, vol. ii., Fig. 283, p. 550.

CASE OF A MAN BLIND FROM CONGENITAL CATARACT WHO ACQUIRED SIGHT AFTER AN OPERATION WHEN HE WAS 30 YEARS OF AGE.

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A MAN, aged 30 years, blind from birth, was brought to the Glasgow Ophthalmic Institution on Feb. 24th, 1903. He was one of a family of seven, and although, as far as could be ascertained, there was no hereditary predisposition to blindness, one sister, as well as himself, was born blind and another (who died at the age of 35 years) lost her sight when she was two years old. The rest—a brother and three sisters—are said to have been able to see perfectly well. The sister who was born blind, now 33 years of age, was brought up in the Blind Asylum, but the patient himself was allowed to run about as he pleased, no attempt to educate him having ever been made. He became, however, so familiar with the country district (a few miles from Glasgow) in which he resided that he could go about without the slightest fear; and his hearing was so acute that he knew at once if there was anything unusual on a road along which he was walking, and thus he never had any difficulty in keeping himself out of danger. The "sense of obstacles" spoken of by psychologists was indeed developed to such a degree that he hardly ever came in contact with what might be in the way; he seemed to perceive the obstruction as he approached and was thereby enabled to avoid it. As he passed along a road he could tell a wall from a hedge by the sound of the air coming through the leaves and branches of the latter. He could easily go on an errand to any house in his native village, for the resonance of his footfall—quite different in sound when he was passing a building from what it was when he was opposite an open space—enabled him, perfectly familiar as he was with his surroundings, to count the houses as he passed, and thus to turn corners and finally to stop at the one which he wanted. In a strange place, however, he could never trust himself to go about without a guide, because his

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sense of hearing conveyed nothing to him beyond the difference between passing buildings or open spaces, and number could not come in to render the auditory impressions definite. Experience taught him in the same manner to find his way about the garden in which he worked, and he learnt to pluck flowers, to arrange them in bunches, and to pack them in boxes for the market not only without the slightest difficulty but with very great accuracy. He distinguished different blossoms partly by touch but chiefly by smell, and by dint of asking questions he got at last to know so much about their form and colour that he could arrange them in a bouquet. He recognised the presence of strangers in the house chiefly by the sense of hearing—for example, he could discriminate persons whom he knew by the sound of their respiration, and he was at once cognisant of any breathing with which he was unfamiliar. Besides this, however, he said that if he came into the house when any strange person was there he experienced a sense of "fulness." He was unable to put this in clearer terms and the feeling may correspond to that ascribed by Wardrop in 1813 in his "History of James Mitchell, a Boy Born Blind and Deaf," to a highly developed sense of smell. Occasionally he worked in the harvest field and he could bind the corn and arrange the stooks as well as any of the other labourers. He said that he was even able to build the sheaves on a cart and naïvely added that although the load might not look "elegant" yet it always remained firm on the cart. At other times he assisted in trimming turnips with a large sharp knife and only on one occasion did he cut himself. In the winter he was employed by a farmer to feed cattle, and as he walked along the byre his sense of hearing guided him unerringly to the stalls where the cows stood, so that he had no difficulty whatever in carrying food to them and placing it in the troughs.

The eyes were small and deeply sunk and they moved continuously in the sockets and there was a very pronounced alternating convergent squint. The irides were natural, the pupils were active, and the intra-ocular tension was normal, but both lenses were completely cataractous. The patient was quite unable to distinguish objects, although he could tell day from night and could easily perceive a light and locate it accurately; and in this he resembled the boy Mitchell who could clearly discriminate light; but, unlike him, he does not appear to have had pleasure in its brightness, and as he seems to have had no perception of bright colours the opacity was probably more complete. As the cataract seemed to be the only obstacle to vision I resolved to operate and I extracted the lens from the right eye on March 11th and that from the left eye a week later. Prior to the former operation I made a preliminary iridectomy in order to test the vulnerability of the ocular tissues. Chloroform was administered as the patient was quite unable to control the movements of his eyes, and this ocular restlessness proved afterwards to be very troublesome, the constant motion under the dressings causing so much irritation that the bandage had to be removed and dark spectacles substituted. Both lenses were small and shrivelled and the nucleus of the right was calcareous. For about ten days after the operation on the left eye the patient appeared to be quite dazed and could not realise that he was seeing. The size of everything in the ward seemed to be very much exaggerated and on that account he had great difficulty in interpreting what he saw, but as he is inquisitive and has a keen desire for knowledge he took from the outset a most intelligent interest in his own case and asked numerous questions of his fellow patients. The first thing he actually perceived was the face of the house surgeon. He said that at first he did not know what it was that he saw, but that when Dr. Stewart asked him to look down the sense of hearing guided his eye straight to the point whence the sound came, and then, recalling what he knew from having felt his own face, he realised that this must be a mouth, and that he must be looking at a face. Once he properly understood what vision meant he made very rapid progress and his extraordinarily retentive memory enabled him to take full advantage of everything that he was told. He was quite ignorant of colour but learned to distinguish hues very quickly. The first tint that he saw was red. A red blanket lay across the foot of his bed. He asked what it was and was told and never afterwards did he have the slightest hesitation in discriminating red again. He was shown a narcissus and on being asked to describe it he immediately recognised the flower and knew from his old bouquet-making experience that it was white and yellow, but he now for the first time also became aware of the little red band in the centre and at once called attention to it. When he was shown a bunch of daffodils he recognised them by their smell and immediately said that they must be yellow. The colour that took him longest to master was green, but he can now name all ordinary tints readily and correctly. His difficulty with green is hard to explain unless it be that with green he has no smell-association such as he had with coloured flowers. Unlike Locke's blind man, who imagined that "scarlet was like the sound of a trumpet," he does not seem to connect any distinct ideas with particular colours except that he said that red gave him a feeling of pleasure and that the first time he saw yellow he became so sick that he thought he would vomit. The latter feeling, however, has never recurred.

He rapidly learned the letters of the alphabet and figures and he will soon be able to read and to reckon. From the very first he saw everything in its actual position, showing that the retinal inversion of a picture is interpreted psychically without any education.

One of the things that gave him peculiar pleasure was looking at the face of a watch which he had borrowed from a fellow patient. Within a day or two of his having got the loan of it he astonished me by announcing that he was able to tell the time. When I asked him how he had learned so quickly he explained that he did not understand the figures on the dial, but he had been told how to count the hours and that each space between the "black marks" meant five minutes. When asked to distinguish between a ball and a toy brick he looked at them attentively for a considerable time, his hands meanwhile moving nervously, as if he were trying to translate what he saw by comparing it with an imaginary tactile impression, and then he described both correctly. He explained that he was so much in the habit of handling objects that he had come to have a "notion in his mind" regarding the form of things. He could count accurately after he had looked at objects one by one and seemed to derive much help in his calculations by pointing with his finger. Here again he seems to translate touch into vision and to arrive at a perception of the whole through the perception of the individual parts. He cannot take things in at a glance. He does not see the passers-by on the opposite side of the street quickly. He looks most intently and moves his head backwards and forwards and from side to side as if trying to get a view of them all round before he can make up his mind what he is seeing; in a room, however, he can distinguish things much more quickly. With any complex outline, however, or group of outlines, he still has considerable difficulty, though pictures are no longer to him, as they were at first, mere masses of confused colour.

He was able to estimate size and distance more readily than might have been anticipated, although he said that he felt that if he were out of doors by himself he would be "wandered." From the time he got out of bed after the operation he could guide himself with ease through a doorway and walk about on the level, but he had considerable difficulty in ascending a stair, because the steps seemed so high that to begin with he raised his foot much farther than was necessary and without meaning to do so went up two steps at a time. Whenever he discovered his mistake he began to pay attention to the rise of each and he has now no difficulty in estimating their height. This, of course, was part of his difficulty of judging distance, though when he first looked out of a window on to the street and saw the pavement below he said that he felt that if he had a stick he should be able to touch it and thus he had not the feeling recorded of the boy operated upon by Cheselden in 1728 who thought that all objects he saw "touched his eyes," just as he had formerly got his impressions of things by pressure against the skin. Unlike him, also, the patient did not retain his faculty of moving easily about in the dark. Before the operation he could guide himself fearlessly through a ward without coming in contact with the beds or any other obstacle that might be in the way, but since he has been able to see he says that he has lost all that feeling of confidence and when his eyes are shut he is afraid to move and is impelled to open them to ascertain where he is going—so much so that he does not know what he would do if he again became blind.

The squint and ocular restlessness are less pronounced than they were, but the patient has still very little control over the movements of the eyes. When he is requested to look in any particular direction he is unable to cause the ocular muscles to do what he wishes, and the balls oscillate and one or other turns inwards to such an extent that a

portion of the cornea is hidden by the inner canthus. This want of control renders it very difficult to make a satisfactory ophthalmoscopic examination, but as far as can be made out the fundus oculi is normal; indeed, the functional activity of the optic nerves since the cataracts were removed is very remarkable and is in striking contrast to the purposeless muscular movements. Disuse has crippled the function of the latter, but seems to have had but little effect on the activity of the former. The eye is a receptive organ and the light that gained access to the retina through the opaque lens proved stimulus sufficient to maintain the optic nerve in health, while the want of visual power deprived the coördinating centre in the brain of all stimulus to develop and hence the ocular muscles are not trained to obey the dictates of the will.

I am indebted to Mr. W. G. MacDonald, one of my students, for bringing this case under my notice.

Glasgow.

SOME OBSERVATIONS ON THE BLOOD GASES IN DIABETES.

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Minkowski and Stadelmann were, so far as we know, the founders in the early "eighties" of the view that in diabetic coma we have to deal with an acid intoxication. In the 20 years which have since elapsed this view has steadily gained ground.

It has been shown by Walter that a condition of unconsciousness with deep respirations can be produced in herbivora by the action of acids put into the stomach, and in these animals the alkalinity of the blood was diminished and its content of carbon dioxide was reduced from 32 to 2 or 3 volumes per cent. In carnivora similar results have been obtained though with less ease, owing to the chemical mechanism by which flesh-eaters are able to neutralise considerable quantities of acid by the production of ammonia. In man it is known that the alkalinity of the blood is diminished in diabetic coma and Kraus (confirming Minkowski) found the CO_2 content of the blood constantly low in 13 cases of diabetic coma. The average was about 15 volumes per cent., with a maximum of 19·8 and a minimum of 9 8 volumes per cent. In some of these cases titration of the blood was carried out and the alkalinity was found to be depressed.

We have made estimations of the carbon dioxide in the blood and its alkalinity in 23 samples of blood from 15 cases, eight being cases of diabetic coma, three of diabetes without coma, and four being from cases of œdema of the lung, pancreatic disease, pernicious anæmia, and ascites respectively. We have also estimated in eight cases the carbon dioxide in the urine and in six cases the capacity of the blood and urine to take up that gas. In two of the cases of diabetic coma the ammonia, the oxybutyric acid and acetone, and the total nitrogen in the urine were also estimated daily, as well as the nitrogen in the food. Histological examinations of the pancreas have been made in five fatal cases.

The gases in the blood were estimated with Hill's blood pump, five or more cubic centimetres being taken for the analysis from a vein by means of an antitoxin syringe. In several cases duplicate estimations were also made with the apparatus of Barcroft and Haldane. The alkalinity of the blood was estimated by Wright's method and is expressed below in terms of normal alkali. The average alkalinity of healthy serum corresponds, according to Wright, to about $\frac{N}{30}$ NaOH. In our non-diabetic cases it has been rather higher—e.g., from $\frac{N}{25}$ to $\frac{N}{30}$.[1]

We are deeply indebted to the physicians of Guy's Hospital for permission to investigate their cases and especially to Dr. Newton Pitt under whose care were five of the patients.

An account in full of the observations, which commenced last October and are still in progress, will in course of time be published. The accompanying table gives some of the more important figures which have been obtained.

TABLE OF RESULTS.

Case.	Remarks.	Date.	Carbon dioxide in the blood (volumes per cent.).	Alkalinity of the blood.	Total carbon dioxide in the urine (volumes per cent.).	Saturation capacity for carbon dioxide of the blood (volumes per cent.).	Saturation capacity for carbon dioxide of the urine (volumes per cent.).
1	Diabetic coma.	Oct. 14th, 1902.	13·0	N/70	—	—	—
	After alkali administration.	Oct. 15th, 1902.	16·8	—	—	—	—
2	Diabetic coma.	Oct. 17th, 1902.	24·0	N/80	—	—	—
3	Diabetic coma.	Dec. 2nd, 1902.	14·8	N/57	—	—	—
	After alkali.	Dec. 3rd, 1902.	—	N/50	—	220	—
	Later.	Dec. 3rd, 1902.	(a) 13·8 (b) 13·7	N/45	5·1	—	82
	Later.	—	—	N/45	—	—	—
4	Diabetic coma.	Dec. 14th, 1902.	(a) 22·8 (b) 22·1	N/60	5·0	301	91
5	Diabetes.	Dec. 19th, 1902.	33·4	N/32	7·1	208	99
	After alkali some days.	Feb. 19th, 1903.	28·1	N/30	8·9	238	93
6	Diabetes.	Feb. 9th, 1903.	24·2	N/45	—	—	—
7	Diabetic coma.	Feb. 9th, 1903.	20·1	N/90	—	—	—
	After alkali administration	Feb 9th, 1903.	—	N/50	—	—	—
8	Dyspnœa.	Feb. 11th, 1903.	25·5	N/30	—	—	—
		Feb. 17th, 1903.	43·0	N/27	11·1	—	—
		Feb. 20th, 1903.	38·8	N/27	8·4	242	—
9	Pancreatic disease.	Feb. 21st, 1903.	56·5	N/25	—	—	87·1
10	Ascites.	Feb. 26th, 1903.	48·5	N/25	6·7	226	139
11	Diabetic coma.	March 17th, 1903.	14·1 12·2	N/45	—	—	—
	After alkali (arm bandaged for 4 minutes).	March 18th, 1903.	39·0	N/27	—	—	—
12	Pernicious anæmia.	March 30th, 1903.	43·2	N/25	2·7 2 6	—	—
13	Diabetic coma.	May 4th, 1903.	25·8	—	—	—	—
14	Diabetic coma.	May 4th, 1903.	17·6	N/40	—	—	—
15	Diabetes.	May 6th, 1903.	52·0	N/25	—	—	—

[1] Some of our results were brought before the Medical Research Society on Feb. 18th last and they are referred to in THE LANCET of March 14th, p. 715, in a paper by Dr. Hale White.